

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>P0866WO-3</b>	<b>FOR FURTHER ACTION</b> <small>see Form PCT/ISA/220 as well as, where applicable, item 5 below.</small>	
International application No. <b>PCT/US2009/001572</b>	International filing date (day/month/year) <b>11/03/2009</b>	(Earliest) Priority Date (day/month/year) <b>19/03/2008</b>
Applicant  <b>CREE, INC.</b>		

This International search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International search report consists of a total of 5 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed  
☐ a translation of the international application into \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (See Box No. II)

3. ☐ **Unity of invention is lacking** (see Box No. III)

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant  
☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☐ the text is approved as submitted by the applicant  
☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. 1  
☒ as suggested by the applicant  
☐ as selected by this Authority, because the applicant failed to suggest a figure  
☐ as selected by this Authority, because this figure better characterizes the invention
- b. ☐ none of the figures is to be published with the abstract

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2009/001572

Box No. IV Text of the abstract (Continuation of item 5 of the first sheet)

A light emitting diode (LED) device(100) having a low index of refraction spacer layer(108) separating the LED chip (102) and a functional layer.(112) The LED chip has a textured light emission surface(106) to increase light extraction from the chip. The spacer layer has an index of refraction that is lower than both the LED chip and the functional layer. Most of the light generated in the LED chip passes easily into the spacer layer due to the textured surface of the chip. At the interface of the spacer layer and the functional layer the light sees a step-up in index of refraction which facilitates transmission. A portion of the light that has passed into the functional layer will be reflected or scattered back toward the spacer layer where some of it will experience total internal reflection. Total internal reflection at this interface may increase extraction efficiency by reducing the amount of light that re-enters the spacer layer and, ultimately, the LED chip where it may be absorbed. The spacer layer also provides a thermal buffer between the LED chip and the functional layer. Thus, the functional layer, which may be a wavelength conversion layer comprising phosphors, for example, is insulated from direct thermal transfer from the LED chip. The spacer layer can also function as a passivation layer.

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2009/001572

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. H01L33/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/012940 A1 (SUH HYO W [KR] ET AL) 18 January 2007 (2007-01-18)	1-6, 8-21, 23-40
Y	paragraph [0008] - paragraph [0009] paragraph [0031] - paragraph [0064]; figures 3-6	7,22
Y	----- DE 10 2005 062514 A1 (OSRAM OPTO SEMICONDUCTORS GMBH [DE]) 29 March 2007 (2007-03-29)	7,22
A	paragraph [0052] - paragraph [0069]; figures 1-3	1-6, 8-21, 23-40
A	----- US 2006/091788 A1 (YAN XIANTAO [US]) 4 May 2006 (2006-05-04) paragraph [0032] - paragraph [0061]; figures 3-7	1-40
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

\* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

2 July 2009

Date of mailing of the international search report

17/07/2009

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# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2009/001572

**C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2005/211991 A1 (MORI YUKI [JP] ET AL) 29 September 2005 (2005-09-29) paragraph [0059] - paragraph [0122]; figures 1-3 -----	1-40
A	EP 0 732 740 A (SIEMENS AG [DE]) 18 September 1996 (1996-09-18) column 1, line 3 - column 4, line 19; figure 1 -----	1-40
A	WO 2008/003176 A (TIR TECHNOLOGY LP [CA]; ASHDOWN IAN [CA]; HARRAH SHANE [US]) 10 January 2008 (2008-01-10) paragraph [0063] - paragraph [0069]; figures 1,2 -----	1-40

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2009/001572

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007012940 A1	18-01-2007	JP 2007027751 A	01-02-2007
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		KR 20080059607 A	30-06-2008
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		KR 20090031446 A	25-03-2009